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Arch 384 research essay

GRT - KING STREET STATION

GRAND RIVER TRANSIT

When presented with the challenge of designing a transportation hub to be sustainable while simultaneously using concrete as its main construction material, we had to grapple with the apparent disconnect between the material and the goals for the finished station. The environmental impact of the manufacture of cement is of great concern when designing a building based on principles of sustainability, and therefore it became very important to propose a structure that capitalized on the beneficial properties of concrete design, while minimizing some of the negative effects of using such a material. Where one might choose a renewable material such as wood for construction of a sustainable project, we could not make such a choice, therefore properties such as durability and ease of pre-fabrication factored heavily into our designs for a concrete structure, as we devveloped systems for handling sotrm water and solar heat gain, and for reinvigorating the site with new vegetation.

Research for this project was conducted in four areas; typology, siting, transit, and materiality. Precedent studies delved not only into existing buildings for public transportation, but also involved other structures built using concrete in the hopes of finding inspiration in both function and materiality.

Typology

The design for the GRT King Street Station calls for a long, low building that hugs the existing Grand Trunk train lines running east-west through Kitchener. The hub acts as a inhabitable bridge that both metaphorically joins the growing downtown areas of both Kitchener and Waterloo, as well as literally making the connection from the east side of Kitchener to the west, over King Street. The GRT hub is modeled after the train stations of the early industrialized period such as Paddington Station in London, England and Union Station in Toronto, Ontario. These structures, constructed at the edges of the rail lines they support, have grand, cavernous spaces leading to an arrangement of sub spaces parallel to the train tracks. In these stations, one initially enters into a great hall, which then leads through a succession of smaller spaces before terminating in covered platforms at the train tracks. While spacious and grand inside, these stations present a more severe and closed off face to passersby. Modern structures such as Strasbourg's Terminus Hoenheim–nord by Zaha Hadid served as inspiration for how a design may embody the movement and energy of travel [1]. Hadid's design seems to channel the motions of passengers as they arrive via car, bus, or bicycle, gathering them under a great concrete canopy before trains propel them into the centre of the city.[2] This played to the desire to create a 'transit theatre' where the movements of commuters were displayed rather than concealed, led to the reorganization of program within the transit hub, to create a series of spaces that were connected at their ends, rather than lined up side by side. The grand space of the train hall therefore opens to both the public plaza to the south and the train lines to the north. This hall facilitates travel along the Grand Trunk line, either by VIA passenger trains or GO commuter trains, as well as housing news stands, convenience shops, a restaurant, and café. To the west of the main hall is the entrance atrium, where tickets for bus, LRT, GO, or VIA train can be purchased. This space is the intermediary between the great hall and the pedestrian bridge over King Street which leads to LRT stops located in shelters beneath the bridge.

Top: Terminus Hoenheim–nord,_Strasbourg, France
Middle: Union Station_Toronto, Ontario
Bottom: Paddington Station_London, England

Siting

By selecting a site in Kitchener, Ontario, the GRT transit hub could be located near geographical centre of the tri-city region, enabling access to existing rail lines and the proposed high-speed transit corridor between Waterloo and Cambridge. At the fringes of the commercial core of Kitchener, King Street Station is bordered by loft residences and the University of Waterloo School of Pharmacy, a building which demarcates the current northward push of the city core. As development expands along King Street, the GRT hub would become a beacon for this transformation of underused industrial buildings into vibrant city fabric, as well as firmly connecting the tri-city area to the greater transportation network of southwestern Ontario.

The location of a rambling, largely vacant industrial building to the north of the King Street site will facilitate future expansion, allowing for both an increase in the number of rail lines passing through the hub and the construction of additional platforms. This factory, currently a hodgepodge of additions, exposed services, and storage towers built onto a turn of the century warehouse structure, is large enough to accommodate an expansion of services offered in the transit hub as well was providing space for retail, restaurant, and office occupancies, further entrenching the building into the activities of the downtown. Adjacency to the established traffic patterns of Kitchener will allow the GRT hub to incorporate existing bus lines and train schedules into the expanded transit services that it offers.

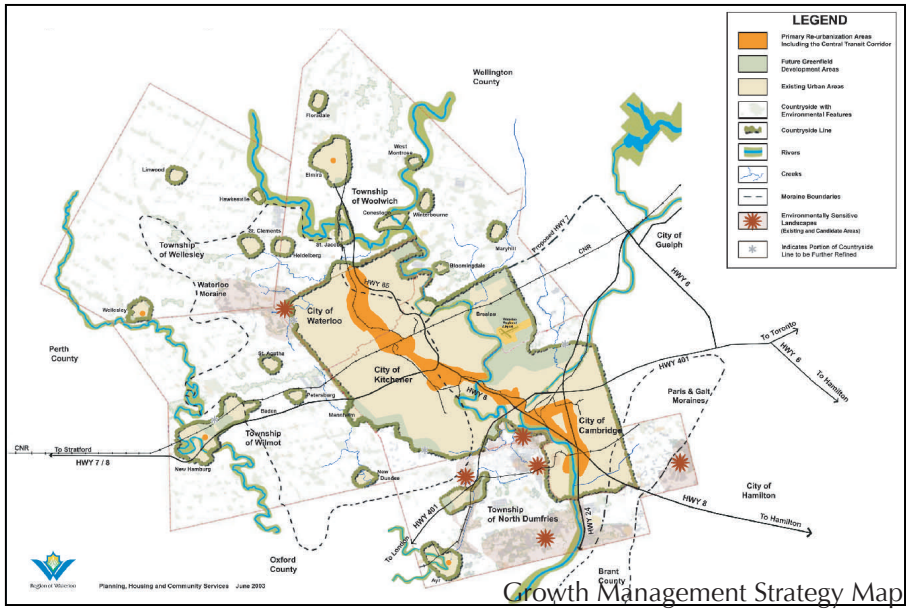
Currently the site is a typical commercial property, in that it is largely covered in asphalt, with no functioning connections between the three parking lots, and features plantings only at its perimeter. It is envisioned that the business currently located on the site would relocate, either to adjacent vacant manufacturing buildings or into the expanded hub, as the site is transformed into a more vital address.

Transit

"Good transportation and communication are not only among the most difficult things to achieve; they are also basic necessities. The point of cities is multiplicity of choice. It is impossible to take advantage of multiplicity of choice without being able to get around easily." [3]

Jane Jacobs

The Death and Life of Great American Cities



Growth Management Strategy Map

source: Region of Waterloo Growth Management Strategy

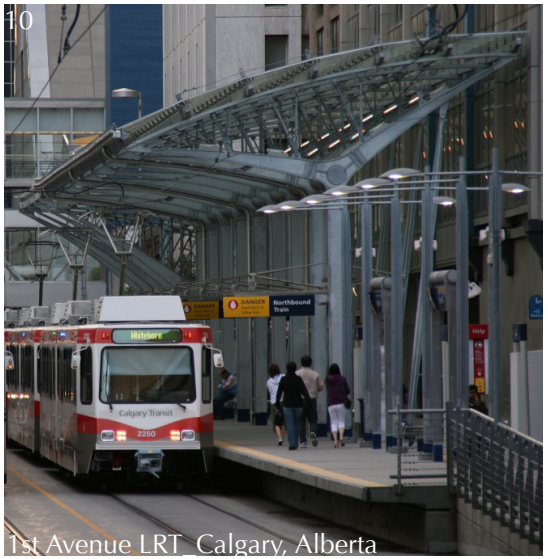
7 Full Site, View From the School of Pharmacy

8 Grand Trunk Line, View From the West

9 Grand Trunk Line, View From the East

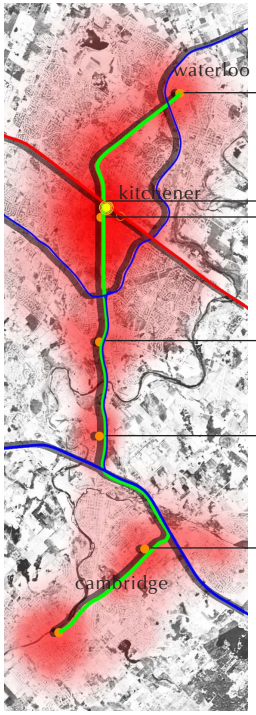
The Waterloo region has been debating the construction of a greater transportation network to bridge the cities of Waterloo, Kitchener, and Cambridge for several years now. Options ranging from dedicated bus lanes to monorails have been proposed, though the most recent direction that the city is taking is in the direction of light rail trams. Taking our inspiration from the growth management strategy of the region of Waterloo, we propose an LRT corridor that would initially move north-south between the three cities, linking with existing bus infrastructure, with it's nexus at the King Street hub. As the system develops, additional LRT lines would allow the trams to reach further into the suburban areas of the tri-city and nearby communities like St. Jacob's, Elmira, or Blair. All of these routes would be tied into the main north-south line and on to the hub, where one could transfer to passenger train lines, buses, or the expanded GO network.

The GRT hub has future expansion at it's core. The site itself sits on the edges of the current commercial zone of Kitchener, envisioning the time when a rich downtown stretches further north along King Street, and when high speed commuter networks such as the GO transit system will connect the 500,000 people currently living in the tri-city area to greater Toronto and beyond [4]. With a population that is expected to increase by nearly 250,000 in the next quarter century, the Waterloo region will require high speed transit to other areas of southwestern Ontario, something that the concerned cities have become increasingly aware of as automotive traffic increases through the region and more country side is lost to low density suburban development and roadways [5]. The issue of sustainable growth and responsible future planning is paramount at this point in time, when we are often forced into choosing between progress and the economy, with the latter winning out over more forward thinking investigations. This crisis of choice is well described by Enrique Peñalosa, the former mayor of Bogota, Columbia, who views the issue more philosophically than is typically seen in the west:



1st Avenue LRT, Calgary, Alberta

"We cannot talk about urban transport until we know what type of a city we want. How do we want to live? Do we want to create a city for humans or a city for automobiles? The important questions are not about engineering, but about ways to live." [6]



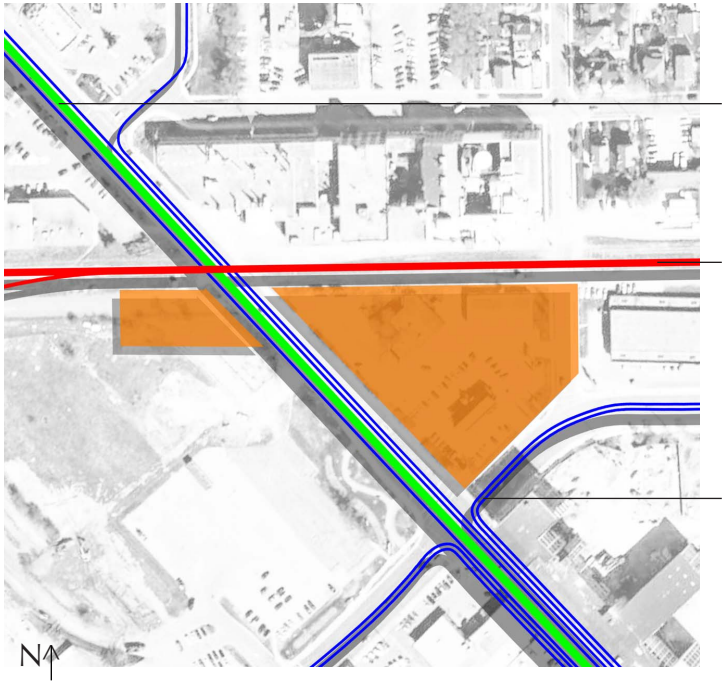
Coach Bus

KING STREET STATION

Charles Street Bus Terminal

Coach Bus

Transit Lines Region Map

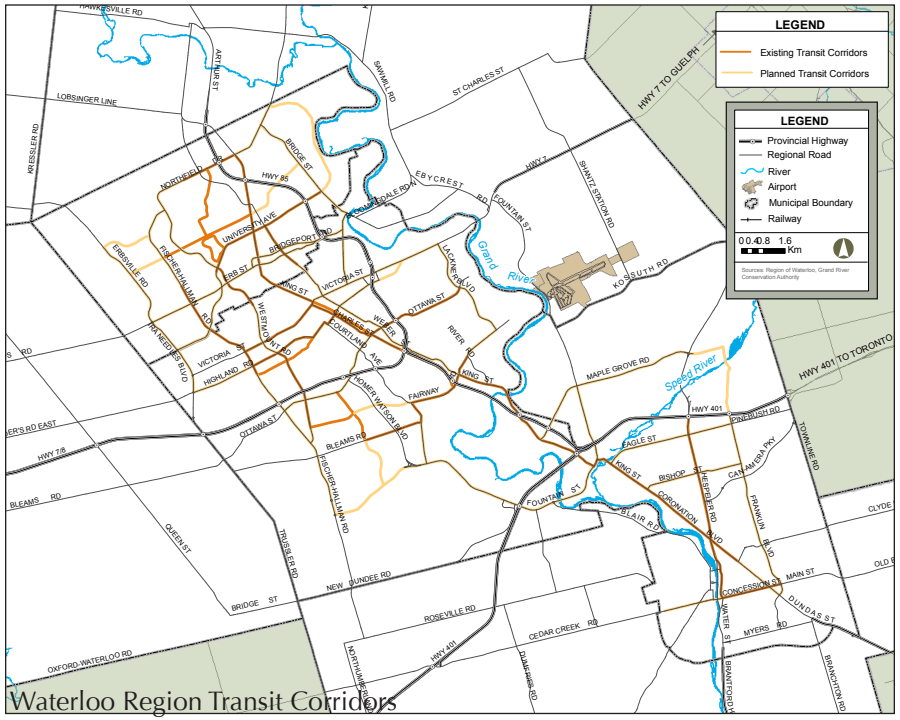


LRT Line

Commuter & Passenger Rail

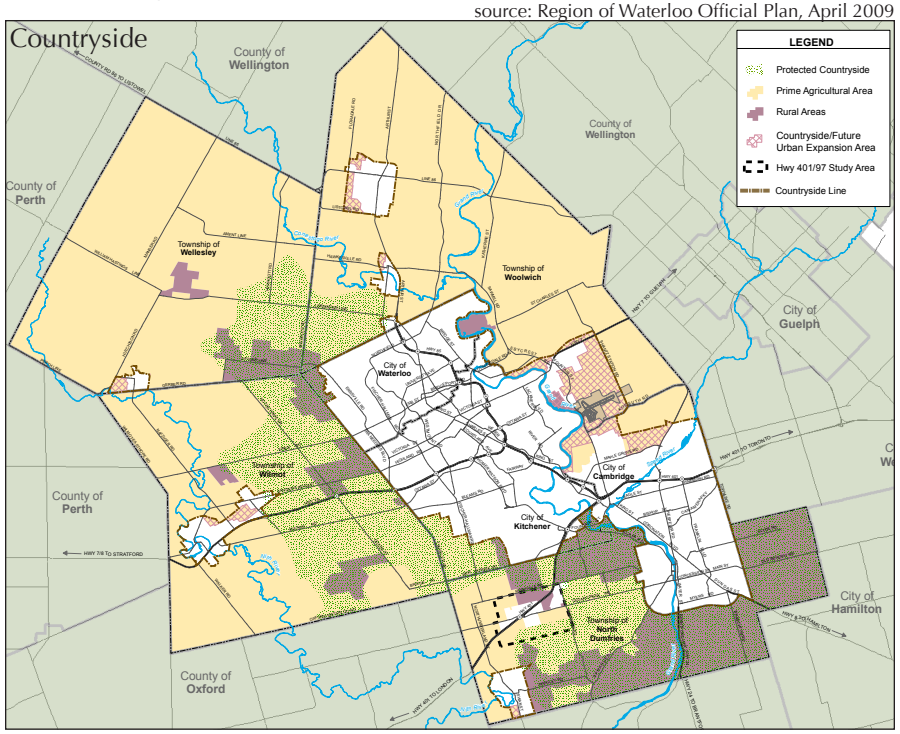
GRT Bus Lines

Transit Lines Site Map



Waterloo Region Transit Corridors

source: Region of Waterloo Official Plan, April 2009

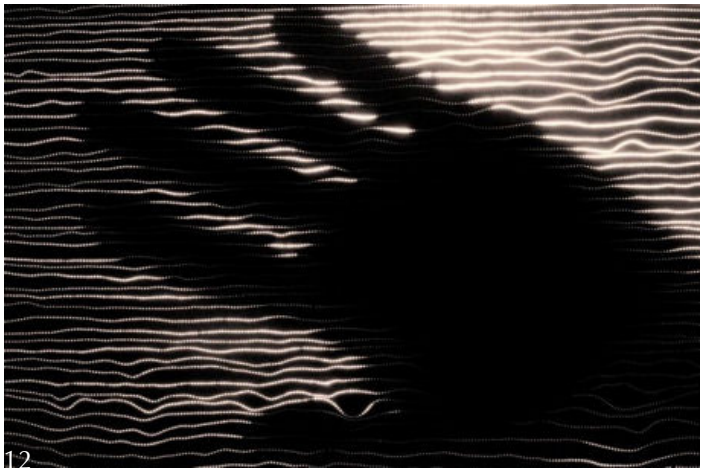


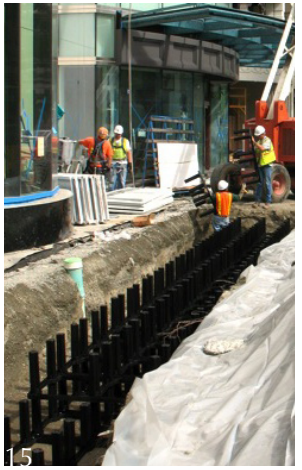
source: Region of Waterloo Official Plan, April 2009

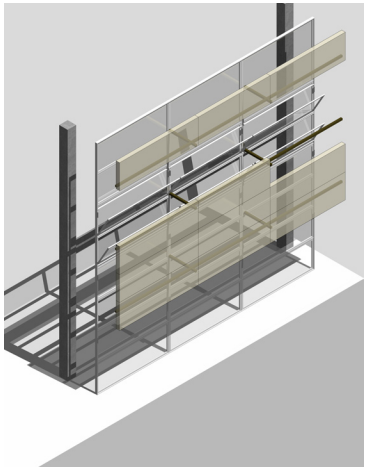
Many developments in technology and construction have changed the nature of concrete and its use in buildings since the discovery of Pozzolan cement. The incorporation of recycled materials or byproducts of other processes such as the production of steel, and the ability to prefabricate building elements have allowed concrete to become a more environmentally friendly material, though the production of cement remains an ecological concern. In order to exploit the best qualities of concrete construction and minimize the negative side-effects we have designed the façade of the GRT hub from a translucent concrete that employs recycled plastic stabilizers and crushed glass aggregate in addition to Portland cement and typical rock aggregate. These panels will transmit light, but will prevent direct solar penetration of the building, considerably reducing solar heat gain. Translucent concrete is in the earliest stages of testing, despite being initially produced in 1999 in association with Rem Koolhaus' Office for Metropolitan Architecture [7]. Certain propriety types such as Luccon contain fiber-optic filaments embedded into the mixture, which given the energy intensity required to fabricate fiber optic cable, and the size of the project, make in unsuitable here. The GRT hub employs a different type of translucent concrete, one which contains considerable post consumer content and can be pre-fabricated in controlled settings and then shipped to the site ready to install. The façade panels are arranged on a one meter by three meter steel grid supported on the main reinforced concrete structure of the transit hub, and hang proud of the glazed curtain walls, creating an enigmatic sun screen that allows the building to glow internally during the day and externally during the evenings. This will create a unique quality of light that alternates between subdued and direct as the translucent concrete panels slide over the façade of the transit hub, revealing glazing beneath.

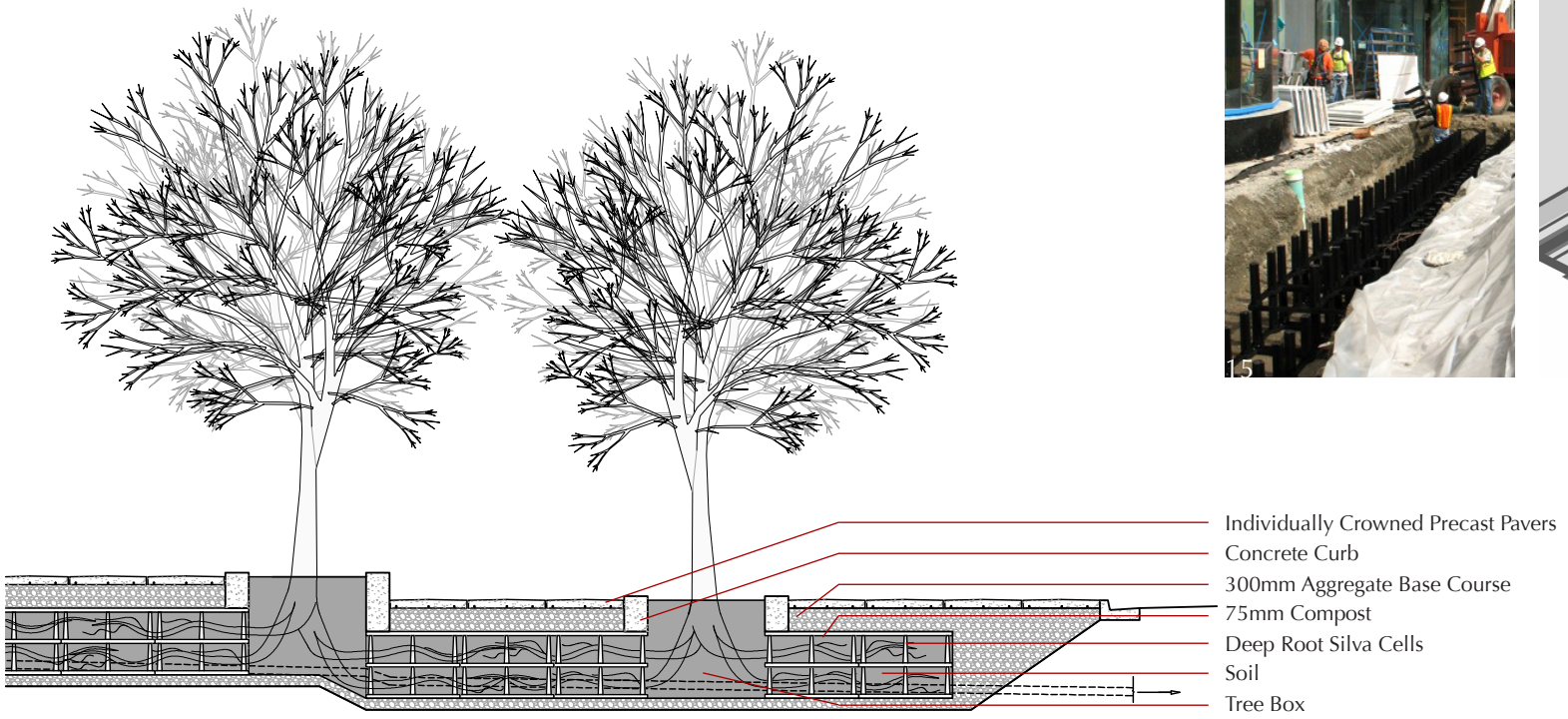
With a hardscaped plaza as large as that of the GRT hub, the movement of water becomes an area of great concern. The site slopes southwards to the downtown, and in rainstorms would direct a great deal of water to the storm sewers on King and Victoria Streets. To alleviate this problem, we have exploited the plasticity of concrete to create an individually crowed precast paving plank system, set on a soil support trellis system. The pavers will allow water to move in all directions away from the centre crown and through the open joints to percolate into the ground below. This strategy alleviates the necessity of complicated systems of drainage and will divert a considerable amount of rainwater from storm sewers and reintroduce it to the ground water supply.

Deep Root Silva Cells are a propriety product designed to maintain a desirable soil density in urban areas where the motion of transit or automotive traffic would otherwise act to compact the soil. These cells encourage root growth in trees and plants and allow water to percolate through the soil to be naturally purified, while also acting to support the paving system at ground level. This system would be ideal for the GRT hub proposal, which is crisscrossed by traffic and transit routes and negotiates a moderate slope, but which is envisioned to support considerable vegetation and a grove of trees. Silva cells have been tested with success by the cities of Seattle and Calgary in a recent phase of streetscape renewal and LRT expansion, and are being incorporated in a growing number of urban landscape projects across North America.



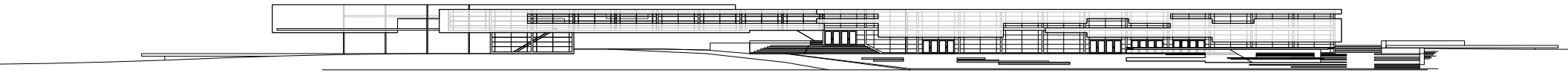






Top: Pozzolan Cement; Fibre-Optic Embedded Concrete; Cement-Free Translucent ‘Concrete’; Translucent Concrete with Glass and Stone Aggregate
Middle: King Street Station_Landscape Section; Silva Cell Construction in Seattle, Washington; Translucent Concrete Façade Rendering

The final form of the King Street Station proposal is that of a sustainable, habitable bridge, capturing the fleeting movements and trajectories of commuters in light and shadow against the backdrop of a vibrant civic site for the city of Kitchener. Taking inspiration from the typology of the grand train halls of the early industrial period, the GRT hub brings the past to the present, responding to its site and embracing sensible design to achieve sustainable goals to accommodate the Waterloo region's transit initiatives today and into the future.



King Street Station_South Elevation

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2 Celant, Germano & Ramirez-Mantagut, Monica, Ed. Zaha Hadid. Cantz; Germany, 2006. (Pg. 101-103)
3 Jacobs, Jane. The Death and Life of Great American Cities. Vintage Books; New York 1992. (Pg 339-340)
4 Region of Waterloo. Region Official Plan. April 2009. (Pg 54)
5 Region of Waterloo. Connecting to the Future: Rapid Transit in the Waterloo Region. 2003.
6 Peñalosa, Enrique from Mau, Bruce, Ed. Massive Change. Phaidon Press; New York 2007. (Pg. 57)
7 Shulman, Ken. X-Ray Architecture. Metropolis, April 2001. Obtained from: www.metropolismag.com

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